Investigation of the light-induced degradation of glutamic acid and stabilisation of glucose on the surface of iron-bearing minerals

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Soil organic matter (SOM) is the most important factor for the maintenance of soil fertility. It is essential to undestand the processes that mineralise or stabilise organic matter in soils. Iron-bearing minerals are ubiquitous in soils and the presence of iron is connected to higher concentrations of organic matter [1]. For the purposes of this study, our hypothesis was that photochemical reactions that occur on the surface of iron-bearing minerals, such as haematite [2, 3] and olivine, could play a role on the mineralisation or stabilisation of SOM. As a simple analogue we used glutamic acid and glucose.

In batch photochemical experiments, separate solutions of glutamic acid and glucose have been irradiated with UV light of wavelength 254 nm or 365 nm in the presence of haematite or olivine. These studies have shown that glutamic acid is degraded in the presence of these minerals while, on the other hand, glucose is stabilised [4]. The understanding of the mechanisms that cause the degradation of glutamic but stabilise glucose is of great significance.

Here, we present results of an investigation of the adsorption of the two organics on crystal surfaces of haematite and olivine with Atomic Force Microscopy (AFM).

We used AFM to investigate the adsorption behaviour of the organics, molecular orientation on the surface and yield evidence about the modified rate of photochemical reactions when the organic molecules are adsorbed on the surface of the minerals.

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Relation between chlorophenol and chloroanizol cork content and soil chemical composition

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The natural environmental decay of persistent organic pollutants is a critical environmental concern. The chemical and reactions that lead to pollutant dispersion and dilution process on the soil matrix are uncountable. Those persistent pollutants namely the pentachlorophenols (PCP) present a great problem for some Industries that use their products in the food Industry. For cork industry, the PCP precursor of 2,4,6 - tetrachloropheonol (TCA) in a few concentrations (10 ppt) is a cause to the exclusion of the cork to produce stoppers, because it is one of the causes of cork wine taint.

The content of chlorophenols in cork plates was evaluated in 11 cork piles that provenance from different stands. The chemical characteristics of the soil of those stands were evaluated in terms off: pH, organic matter content, assimilated phosphorus, assimilated potassium, chlorates, calcium; magnesium, sodium, potassium, Ca/Mg ratio.

Chromatographic analyses were carried out on Agilent technology equipped with a mass spectrometry detector and the compounds evaluated was: PCP; 2,4,6 – trichlorophenol (TCP); 2,3,4,6-Tetrachlorophenol (TeCP); TCA; pentachloroanizol (PCA) in the 11 previously piles.

That methodology gives the possibility to the identification of regional zones with probability to have TCA in the cork and that data are very important for the cork industry because the cork that provide from that stands could be have other kind of uses and other kind of methodologies for storage in the factory.

Principal Components Analysis indicated a good correlation between chlorates content and Ca/Mg ratio and the concentration of TCA and PCA. The organic matter in the soil influences the TCP content.

This is a preliminary approach about the possibility of correlation between the content of chlorophenols of the analyzed cork plates and the soils of their origin, but other studies are in progress to evaluate and validate that relation.